Government Investment and Follow-on Private Sector Investment in Pakistan, 1972-1995

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The possibility that government investment can stimulate private sector investment has long been suggested. Until recently, an appropriate model to test for the relationship in developing countries has been absent. In 1984, Blejer and Khan developed and estimated a model for 24 developing countries between 1971 and 1979. They found that higher rates of investment took place when the private sector took a large role in capital formation. This paper estimates a similar model for one developing country, Pakistan, for the period 1972 to 1995. Our results are broadly similar to those obtained by Blejer and Khan and we suggest ways for the Pakistan government to stimulate the private sector by selective types of public investment.

I. Introduction

The possibility that government investment, especially infrastructure, can stimulate private sector investment has long intrigued economists and policy makers alike. The government's role in prompting private sector investment is clearly suggested in Hirschman's (1958) unbalanced development strategy. Since the private sector in many developing countries might be unwilling to undertake large scale investment projects with the concomitant risks, the government could act to lower costs of commercial production in sectors like transportation and energy and thus stimulate private investment. If increases in government investment (economic or social overhead capital) prompt private sector investment, it would seem that the public sector has a powerful tool at its disposal to help guide the nation's development.

Government investment is envisioned as creating profitable areas of investment for both current and new private investors. If developing countries pursue Hirschman's growth strategy they should experience sustained rates of private sector investment stemming from the expansion of economic and social overhead capital.

One of the difficulties in learning more about the effectiveness of government investment programs is a large gap between theory and model specification in developing countries. In an important study, Blejer and Khan (1984a) (B & K) developed and estimated a model to describe the relationship between private and public sector investment in developing countries. They examined pooled data for 24 countries between 1971 and 1979 and found that higher rates of investment took place when the private sector took a larger role in capital formation. Also they noted that the average growth rate of the economy went hand in hand with larger shares of private investment.

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B & K noted that "Such patterns clearly indicate the importance of private investment behavior in developing countries and provide the motivation for specifying and testing formal models of private capital formation." (1984a, p. 382; also see Blejer and Khan (1984b)). In the absence of any country-by-country estimates, they suggested their results "··· can be taken as indicative of the relationship between public and private investment in an average developing country ····." (p. 399).

A problem of cross-national studies - and "average developing country" results -- is that policy makers are often left without any country-specific options. Although B & K are to be commended in efforts to ensure cross-country consistency, similar single country estimates are likely to be more useful than similar cross-country data. Our purpose in this paper is to narrow the literature gap by estimating B & K's model for one developing country, Pakistan, for the period 1972 to 1995.

At a minimum, we would like to replicate B & K's cross-country results for a single developing country. However we go a step further and expand the categories of public sector investment categories from one (as in B & K) to six -- total, energy, post office, railway, local authority, and rural works. As well, we expand the results by including private sector investment for four sectors of the economy: total, large-scale, small-scale, and non-manufacturing sectors.

II. Infrastructure and Manufacturing Output

Increasing the efficiency of the industrial sector is an important aspect of economic development. Sectoral policies which signal and guide efficient shifts in investment are essential. The Pakistan government has been implementing trade, industrial and financial policy changes recently, but progress has been slow and often inadequate to achieve the stated objectives. Industrial development has also been hampered by low public investment in infrastructure (World Bank (1991)). In Pakistan, the patterns of private sector investment in manufacturing have differed considerably over time by size, with much less volatility in small scale manufacturing than in large scale manufacturing. After the Bhutto administration fell, a strong surge in private investment took place in both large and small scale manufacturing firms. The net result of these trends has been a shift in the percentage of private sector investment in large scale manufacturing from 20.7% in 1972 to 32.7% by 1990. Correspondingly, government investment has shifted from large scale manufacturing to the energy sector. Approximately 5% of public investment was allocated to the energy sector in 1970; by 1990 this had grown to nearly 33%. (World Bank (1991)).

In a recent paper we suggested the recent slowdown in manufacturing output in Pakistan is due to a "bottleneck" of infrastructure. Additionally we found very little coordination between the public sector and the manufacturing sector. (Looney and Frederiksen (1995)). Thus it is important to assess what impact Pakistan's infrastructure investment program has had (or is likely to have) on private sector manufacturing expansion. Specifically we need to examine whether private sector investment (a) responded to increases in public investment, (b) is prompted more by one type of government infrastructure than another, (c) differs by firm size, and (d) whether any offsetting effects occur when government funds large infrastructure projects.

There are a number of reasons to believe that private investment in Pakistan is correlated to government investment (see Tun Wai and Wong (1982)). If resources are under-utilized, an

increase in government investment would increase income directly and indirectly through the multiplier effect. As incomes grow, the private sector would react by increasing investment. Second, since a large part of government investment is concentrated in infrastructure projects (such as transportation, electric power, irrigation, and the like) costs of production would fall and thereby increase profitability for private investors. Third, even if government investment were in secondary or tertiary industries, the establishment of new factories would increase demand and induce higher levels of private investment.

III. The Blejer and Khan Model

As B & K point out, flexible accelerator investment are well established in the literature (Jorgenson (1967, 1971) and Hall (1977)) with variants by Bischoff (1969, 1971) and Clark (1979). Applying these models to developing countries has been difficult due primarily to institutional and structural factors, including the absence of functioning financial markets, a multitude of market distortions, and little reliable data. Importantly, some types of government investment fell into both public and private investment categories. B & K concluded that "··· these assorted problems have in the past tended to inhibit the modeling of private investment along standard theoretical lines for developing countries." (p. 380).

Their model[1] explicitly incorporates two important policy variables -- bank credit to the private sector and public sector investment -- and relates them to private sector investment. Interestingly, their model allows for any negative effects of government investment such as crowding out, inflation, and wage increases. A major contribution was the separation of public sector investment into (a) infrastructure and (b) non-infrastructure categories. They hypothesize that private investment will respond differently by type of public investment.

The starting point for the B & K partial adjustment gross investment model is:

$$\triangle IP_t = \beta(IP^*_t - IP_{t-1}) \tag{1}$$

or:

$$IP_t = \beta IP^*_t + (1 - \beta)IP_{t-1}, \tag{2}$$

where IP is the actual level, and IP^* is the desired level of gross private investment, respectively, t represents the time period, and β is the coefficient of adjustment where $0 \leq \beta \leq 1$. The actual stock of capital adjusts between the desired level and the actual level in period (t-1). In the steady state, desired level of private investment is:

$$IP^*_t = [1 - (1 - \delta)L]KP^*_t, \tag{3}$$

where KP^* is the capital stock desired in future periods which is related to a corresponding level of output as follows:

$$KP^*_t = a YR_t. \tag{4}$$

1. For a much fuller description of the model, see Blejer and Khan (1984a).

Combining equations (1) through (4), we get:

$$IP_t = \beta a [1-(1-\delta)L] YR_t + (1-\delta) IP_{t-1}. \tag{5}$$

In this form, only data on gross private investment (usually available in developing countries) is required for estimation. As pointed out by Coen (1971), the coefficient β is assumed to vary systematically with factors directly influencing private investors trying to achieve an optimum level of investment.

B & K suggest three major factors which influence private investment: business cycle, the availability of credit to the private sector (and hence the importance of monetary policy), and the level of public sector investment. For the latter, no consensus exists as to the net effect of public sector investment since crowding out might occur if the government uses the limited physical or financial resources or produces an output to compete with the private sector. Thus, the net effect of government investment on private investment depends on the extent of crowding out on the one hand, and the complementarity of public and private investment on the other hand. Crowding out is measured by the unexpected change in bank credit to the private sector $(\triangle PCU)$ calculated as the difference between the actual and the regressed value of private credit from the year before.

The coefficient of adjustment, β, depends on the unexpected change in bank credit to the private sector and government investment (GI):

$$\beta = b_0 + \frac{(b_1 \triangle PCU_t + b_2 GI_t)}{(IP_t^* - IP_{t-1})}. \tag{6}$$

Substituting (6) into equation (2) we get:

$$IP_t = b_0 (IP_t^* - IP_{t-1}) + b_1 \triangle PCU_t + b_2 GI_t. \tag{7}$$

Following B & K, it can be shown that:

$$IP_t = b_0 a [YR_{t-1} - (1-\delta)YR_{t-2}] + b_1 \triangle PCU_t + b_2 GI_t + b_3 \triangle GI_t + (1-b_0)IP_{t-1}. \tag{8}$$

The effects of government policy on private investment can be obtained by estimating the coefficients for credit to the private sector (b_1), government investment (b_2 and b_3).

B & K suggested a method to estimate the infrastructure and non-infrastructure components of government investment -- necessary since their effects on private investment might offset each other. Assuming that infrastructure investment is essentially a long-term phenomenon, expected government investment is an acceptable proxy in the following form:

$$GI_t = p_0 + p_1 GI_{t-1}. \tag{9}$$

The predicted values (i.e., expected) represent the infrastructure (long-term) component, the residual values (i.e., unexpected) represent the non-infrastructure (short-term) component of government investment. Thus equation (8) becomes:

$$IP_t = b_0 a [YR_{t-1} - (1 - \delta)YR_{t-2}] + b_1 \triangle PCU_t + b_2 GIE_t + b_3 \triangle GIU_t + (1 - b_0)IP_{t-1}, \quad (10)$$

where GIE and GIU are expected and unexpected government investment, respectively. A negative sign for b_3 would indicate crowding out. This equation is estimated for various types of infrastructure and non-infrastructure investment types for Pakistan for the period 1972-1990. Infrastructure data were drawn form The World Bank (1983 and 1991) and Gross Domestic Product (GDP) data and the GDP price deflator were from the International Monetary Fund, International Financial Statistics (various issues) and the government of Pakistan, Economic Survey (various issues).

IV. Empirical Results

The model developed above suggests that private sector investment depends on the lagged change in GDP ($\triangle GDP_{t-1}$), the change in private sector credit ($\triangle PCU$), government infrastructure (i.e., expected) investment (GIE), government non-infrastructure (i.e., unexpected) investment (GIU), and the lagged value of private investment (IP_{t-1}). B & K estimated their model for a single type of private investment. We estimated a similar model for four types of private investment: total manufacturing and large-scale manufacturing[2] (Table 1) and small-scale manufacturing and non-manufacturing (Table 2). In addition for each of these four categories of private investment, we looked at government investment in infrastructure (GIE) and non-infrastructure (GIU) for the following categories of investment: total, energy, post-office (including telephone and telegraph), railway, local authority, and rural works.[3]

Overall the results are strikingly similar to those obtained by B & K. The adjusted R^2 values are all extremely high indicating that the model explains much of the private sector investment behavior in a single developing country. This results strongly supports the cross-country results obtained earlier by B & K. The estimated coefficients for the lagged private investment variable (IP_{t-1}) are statistically different from zero at the 95 percent level of confidence in all cases - once again supporting the findings of B & K. This capital stock adjustment model clearly indicates that the private sector is attempting to adjust the actual level of capital investment to the optimal level.

Private sector investment in total manufacturing (Table 1, part A) indicates several interesting findings. While the lagged change in GDP and the change in bank credit to the private sector were positive, the estimated coefficients were not statistically different from zero for all types of public investment. As we expected, government infrastructure projects (GIE) on rural works, post offices, and railroads, had little effect in stimulating follow-on private sector investment in manufacturing. On the other hand, total public infrastructure (GIE) and non- infrastructure (GIU)

2. Firms with more than 9 employees.
3. Selected statistics have been reported in this paper. A full set of the regression results can be obtained from the authors on request.

Table 1   Factors Affecting (A) Private Total Manufacturing and (B) Private Large-Scale Manufacturing Investment in Pakistan, 1972-1995: Estimated Coefficients and t-Statistics

Public Investment Type	Independent Variables -- Total Manufacturing Investment					Adj R²
	ΔGDP_{t-1}	ΔPCU	GIE	GIU	IP_{t-1}	
Total Infrastructure	0.04 (0.97)	0.12 (3.08)	0.28 (2.18)	0.31 (2.34)	0.74 (5.73)	0.990
Energy	0.10 (2.31)	0.10 (2.97)	0.39 (3.00)	0.03 (0.27)	0.77 (9.80)	0.993
Post Office, Telephone & Telegraph	0.12 (2.67)	0.09 (1.95)	-2.31 (-1.22)	-1.60 (-1.40)	1.38 (4.61)	0.985
Railway	0.12 (2.74)	0.08 (1.8)	-2.86 (-1.91)	-0.03 (-0.02)	0.98 (21.01)	0.989
Local Authority	0.06 (1.36)	0.10 (2.56)	1.42 (1.92)	0.91 (0.77)	0.92 (12.84)	0.990
Rural Works	0.09 (1.53)	0.11 (2.43)	0.13 (0.14)	-1.23 (-0.82)	1.04 (15.79)	0.984

	Independent Variables -- Large-Scale Manufacturing Investment					Adj R²
	ΔGDP_{t-1}	ΔPCU	GIE	GIU	IP_{t-1}	
Total Infrastructure	0.04 (1.01)	0.12 (3.02)	0.27 (2.15)	0.30 (2.35)	0.72 (5.35)	0.988
Energy	0.10 (2.41)	0.10 (3.05)	0.39 (3.07)	0.03 (0.14)	0.77 (9.17)	0.992
Post Office, Telephone & Telegraph	0.12 (2.71)	0.08 (1.93)	-2.00 (-1.04)	-1.41 (-1.21)	1.35 (4.08)	0.982
Railway	0.12 (2.83)	0.07 (1.79)	-2.94 (-1.94)	0.02 (0.02)	0.97 (19.88)	0.988
Local Authority	0.06 (1.41)	0.10 (2.51)	1.40 (1.94)	0.75 (0.65)	0.90 (11.78)	0.988
Rural Works	0.08 (1.55)	0.10 (2.43)	0.14 (0.15)	-1.12 (-0.76)	1.03 (14.64)	0.981

Note: t-statistics appear in parentheses below the estimated coefficients.

Table 2   Factors Affecting (A) Private Small-Scale Manufacturing and (B) Private Non-Manufacturing Investment in Pakistan, 1972-1995: Estimated Coefficients and t-Statistics

Public Investment Type	Independent Variables -- Small-Scale Manufacturing Investment					Adj R²
	ΔGDP_{t-1}	ΔPCU	GIE	GIU	IP_{t-1}	
Total Infrastructure	-0.06 (-0.24)	0.04 (1.72)	0.14 (1.52)	0.08 (1.03)	0.95 (8.85)	0.997
Energy	0.10 (0.04)	0.10 (0.79)	0.39 (0.51)	0.03 (1.76)	0.77 (17.22)	0.997
Post Office, Telephone & Telegraph	0.04 (2.16)	0.02 (1.29)	-0.04 (-1.02)	-0.10 (-2.63)	1.21 (15.23)	0.998
Railway	0.02 (0.74)	0.02 (0.87)	-0.02 (-0.28)	-0.03 (-0.66)	1.11 (32.71)	0.996
Local Authority	0.06 (0.26)	0.03 (1.83)	-0.08 (-0.22)	0.12 (2.18)	1.14 (25.83)	0.998
Rural Works	0.02 (0.68)	0.02 (0.94)	0.03 (0.07)	-0.01 (-0.04)	1.11 (31.30)	0.996

Public Investment Type	Independent Variables -- Non-Manufacturing Investment					Adj R²
	ΔGDP_{t-1}	ΔPCU	GIE	GIU	IP_{t-1}	
Total Infrastructure	0.02 (0.77)	0.04 (0.17)	0.23 (1.88)	0.18 (2.30)	0.70 (4.31)	0.991
Energy	0.05 (1.56)	-0.08 (-0.37)	0.20 (2.46)	0.06 (0.43)	0.86 (13.07)	0.994
Post Office, Telephone & Telegraph	0.01 (0.43)	0.02 (0.06)	0.22 (0.37)	0.14 (1.49)	0.96 (8.02)	0.985
Railway	0.04 (1.45)	-0.02 (-0.65)	-1.84 (-1.94)	-0.42 (-0.68)	0.97 (26.29)	0.993
Local Authority	0.02 (0.78)	0.03 (0.09)	0.04 (0.04)	-0.63 (-0.66)	1.00 (8.58)	0.988
Rural Works	-0.01 (-0.03)	0.06 (0.29)	-0.38 (-0.83)	-2.09 (-2.59)	1.08 (21.31)	0.994

Note: t-statistics appear in parentheses below the estimated coefficients.

investment and energy infrastructure investment seemed to induce private sector investment. Infrastructure investment by local authorities had a marginally significant impact on private sector investment. These patterns are carried over when private sector large- scale manufacturing investment is examined (Table 1, part B). This is expected since over 90 percent of private sector manufacturing falls into the category of large-scale.

Investment in small-scale manufacturing (Table 2, part A) displayed a number of important differences to how public investment affects private investment. For small-scale manufacturing, both the change in GDP or bank credit to the private sector seem to have little effect affecting private investment. In no case was government infrastructure investment important in stimulating subsequent investment by the private sector. Furthermore, only local authority non-infrastructure investment was significant -- no doubt reflecting a demand pull (rather than supply induced) motivation for private investment in small-scale manufacturing.

For the sake of contrast, we estimated the same model for private investment in non-manufacturing activity (Table 2, part B). As with small-scale manufacturing, private sector credit and the change in GDP were statistically insignificant. It appears that certain types of government investment - especially in rural works - crowds out private investment in non-manufacturing activities. On the other hand, government non-infrastructure investment stimulates the private sector; again, we suggest that this is likely more through demand than supply linkages. The results suggest that it is public infrastructure investment in energy projects that provides the greatest stimulus to private investment in this area.

V. Summary and Conclusions

In what we consider an important work, Blejer and Khan developed a model to examine the importance of different factors which contribute to private sector investment in developing countries. Using pooled data for 24 countries between 1971 and 1979, they concluded that until other studies had examined results for individual countries, their results would be indicative for an average developing country. In this paper, we have tried to close that gap by estimating their model for Pakistan for the period 1972-1990.

Importantly, our results are similar to those found by B & K. The results suggest ways for the government of Pakistan to stimulate the private sector during the next several years of liberalization and economic reform. With the appropriate coordination of public policies, a severe contraction of economic activity need not occur.

In the manufacturing sector, the government needs to be selective if it wants to stimulate private investment; for example, investment by large-scale manufacturing firms appears responsive to only certain types of public investment -- especially in energy. The authorities seem to have little control over small-scale firms. Since this sector accounts for about one-third of value added in manufacturing, the government must finds other ways to stimulate investment if it wants manufacturing output to accelerate.

As suggested by Ashfaque Khan (1988), the proper use of bank credit to the private sector can be an effective tool in inducing private sector investment in the manufacturing sector:

Credit rationing which is itself a component of financial repression is a major impediment

to ⋯ savings, investment and growth, and the interest rate should be left to find their equilibrium levels in a free market environment.

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